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Inventor(s): Marcus DAVIDSSON

Title of Invention: Method for Establishing and Maintaining a Connection

Attorney Docket No.: 45051-00043USPL

Mail Stop Provisional Patent Application
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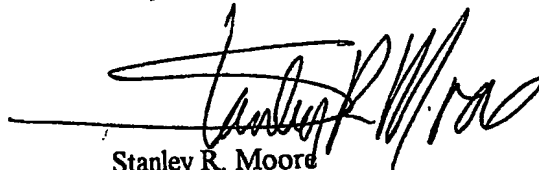
Date: _____ 23, 2003

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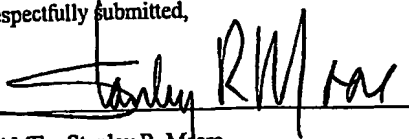| Docket Number: 45051-00043USPL		Type a plus sign (+) inside this box →	+

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TITLE OF THE INVENTION: Method for Establishing and Maintaining a Connection

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ENCLOSED APPLICATION PARTS (check all that apply):

☒ Specification *Number of Pages* **20**

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☐ Small Entity Statement

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Was the invention made by an agency of the United States Government or under a contract with an agency of the United States government?

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Respectfully submitted,

NAME Stanley R. Moore

DATE September 23, 2003

REGISTRATION NO. (if appropriate) **26,958**

☐ Additional inventors are being named on separately numbered sheets attached hereto.

PROVISIONAL APPLICATION FILING ONLY

~~Applicant(s) herein make claim to a new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof as substantially shown or described herein.~~

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METHOD FOR ESTABLISHING AND MAINTAINING A CONNECTION

Technical Field of the Invention

The present invention relates to the field of
5　communication, and more specifically to the field of
establishing and maintaining a connection between a
communication device and a network.

Description of Related Art

10　　In a communication system several protocols may be
provided for obtaining and controlling communication
between a communication device and a network. One such
communication system is a mobile telecommunication system,
such as a GSM (General System for Mobile communication), a
15　GPRS (General Packet Radio Service), or a UMTS (Universal
Mobile Telecommunications System) system. A communication
device, such as a mobile radio terminal, a mobile
telephone, a pager, a communicator, a smartphone, an
electronic organizer, etc. communicates with a core network
20　(CN) via a radio access network, such as the UTRAN (UMTS
Terrestrial Radio Access Network) of the UMTS system or the
BSS (Base Station Sub-system) of the GSM/GPRS system. The
UTRAN comprises one or several nodes B (base stations),
which are controlled by a radio network controller (RNC).
25　Similarly, the BSS comprises one or several base
transceiver stations (base stations) controlled by a base
station controller (BSC).

To keep track of in which of several routing areas
(RA) or location areas (LA) of the system a portable
30　communication device is located, each portable
communication device is assigned an identity, which the
system has knowledge of (see below). The mobility
management protocol is responsible for updating the
location area when a transition from a first to a second
35　area occurs.

The core network may comprise two service domains,
the CS (circuit switched) domain and the PS (packet
switched) domain. In the CS domain, the communication
device may be identified by an international mobile

5   subscriber identity (IMSI) or a temporary mobile subscriber
identity (TMSI), which is a temporary identity within the
LA/RA and which is non-mandatory in the CS domain. In the
PS domain, the communication device may be identified by
IMSI and packet temporary mobile subscriber identity (P-

10 TMSI), which is assigned to the communication device by the
network. The CS domain of the core network may comprise
three network nodes, the MSC/VLR (Mobile Switching
Center/Visitor Location Register), the GMSC (Gateway Mobile
Switching Center) and HLR (Home Location Register).

15 Similarly, the PS domain of the core network may comprise
three network nodes, the SGSN (Serving GPRS Support Node) a
GGSN (Gateway GPRS Support Node) and a HLR.

    Procedures such as attach, paging, and location
update are defined separately for CS and PS. Location area

20 (LA) update may be performed for CS, whereas routing area
(RA) update may be performed for PS. Combined functions are
also available.

    A number of protocols are provided in the
communication device and the communication network, which

25 obtain and control the communication over different
connections or channels. The mobility management (MM)
protocol is responsible for mobility management in the CS
domain, and the GPRS mobility management (GMM) protocol is
responsible in the PS domain. The MM and GMM protocols

30 facilitate mobility management communication that is
logically provided between the core network and the
communication device, and which is not interpreted by the
UTRAN or the BSS. These procedures comprises e.g. location
management for keeping track of the present location and/or

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routing area of the communication device, authentication,
temporary identity management and equipment check.

The MM and GMM protocols obtain and manage signaling
connections for the layers above them in the protocol
5   stack. In the CS domain a point-to-point CS signaling
connection between the MM unit in the communication device
and the MM unit in the CN may be provided. In the PS
domain, a virtual point-to-point PS signaling connection
between the GMM unit in the communication device and the
10 GMM unit in the CN may be provided. These signaling
connections are used by the MM/GMM unit to perform e.g.
location updating towards the CN, and provide upper layer
protocols with secure connection channels. Upper layers
requesting such channels may comprise the CC (Call Control)
15 protocol for control of voice calls, SM (Session
Management) protocol for control of data sessions, and
control of additional messaging services, such as SMS
(Short Message Service), MMS (Multimedia Messaging
Service). The upper layers are requesting the channels by
20 transmitting a connection establishment to the MM/GMM unit,
which will obtain the channel by triggering an
establishment of a signal connection. The signal connection
is set up by lower layers, such as the radio resource (RR)
or radio resource control (RRC) layers.

25   When GMM initiates a procedure in WCDMA (Wideband
Code Division Multiple Access) mode, a PS signaling
connection is triggered by transmitting a connection
establishment request followed by a message for requesting
a certain MM/GMM procedure. If the GMM wishes to maintain
30 the established connection after the MM/GMM procedure is
finished, it may indicate a Follow-On Request (FOR) in a
first message for requesting a certain MM/GMM procedure,
which is transmitted to the CN. A maintained connection is
e.g. desired if the GMM unit from the upper layers has
35 received a connection establishment request, or if it has

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additional procedures to perform. Maintaining a connection
instead of establishing a new connection decreases service
response time, reduces power consumption, saves radio
resources, and enhances quality of services to the upper
5   layers. However, there is a problem in the prior art that
the FOR has to be incorporated into the first message for
establishing the connection. Thus, if the GMM unit receives
an establishment request from an upper layer after the
request for a certain MM/GMM procedure has been transmitted
10   and before the established connection has been terminated,
the connection, might be terminated although a procedure is
pending and awaiting service. If the connection could be
maintained although the request for the MM/GMM procedure
has been transmitted, service time and power consumption
15   could be decreased. The same problem occurs in the CS
domain if the MM unit receives a connection establishment
request or a request for a certain MM procedure from the
upper layer when a connection establishment request has
been transmitted to the network MM unit.
20   WO-01/91382 discloses a system for provided routing
area update message in a UMTS-based network. An attach and
routing area update request is transmitted from a mobile
station to a network node. Follow-on request is sent in the
message if there is pending uplink traffic (signaling or
25   user data). When the network node has processed the
message, an acceptance message is transmitted to the mobile
station, which may finish the procedure by returning a
completion message.

30   Summary of the Invention
It is an object of the invention to provide a method
and apparatus for improving service response time of upper
layers of a protocol stack, when an intermediate protocol
obtains and controls connections between a communication
35   apparatus and a network node.

- 5

According to a first aspect of the invention, a
method in a communication apparatus achieves the object of
the invention. A connection between the communication
apparatus and a network node is established in response to
5   issuing a request relating to a first procedure, such as a
mobility management procedure, issued by a MM/GMM unit
within the communication apparatus. According to the
method, an acceptance message is received in response to
the transmitting of the request. It is also determined
10   whether a request relating to a second procedure, which may
have been issued by an upper layer or an MM/GMM internal
event, is pending. If any request is pending, a maintaining
request, such as a FOR, for maintaining the established
connection is transmitted to the network node.
15   The transmitting of the maintaining request may be
executed if the pending request relating to the second
procedure is received after the request relating to the
first procedure is transmitted and before the acceptance
message is received. Furthermore, the maintaining request
20   may be transmitted separately or be incorporated into a
response or acknowledgement message transmitted in response
to the acceptance message. The established connection may
be terminated when it is no longer in use.
        The connection may be a circuit switched or a packet
25   switched signaling connection. The method may be
incorporated into a mobility management protocol, wherein
e.g. a MM or GMM unit executes the method. The procedure
initiating the request may be a location updating procedure
requiring a signaling connection.
30   According to a second aspect of the invention, a
second method achieves the object of the invention. The
second method being implemented in a network node will
maintain an established connection to a communication
apparatus. A request relating to a specific procedure is
35   received from the communication apparatus. In response to

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said request, an acceptance message is transmitted, which
may comprise any data relating to the request. The
connection is maintained a predetermined period of time
after the acceptance message is transmitted or until a
5   maintaining request is received.

The established connection may be maintained until
the maintaining request for maintaining the connection is
received, or until the time period has lapsed. The
transmitted acceptance message may require an
10   acknowledgement message in return, in which the maintaining
message may be incorporated. However, if an establishment
request is pending a response message comprising the
maintaining message may be transmitted in response to the
acceptance message although the acceptance message does not
15   require so. Therefore, the network node maintains the
connection the predetermined period of time such that the
communication apparatus will have time to prepare and
transmit the acknowledgement message.

According to a third aspect of the invention, a
20   control device for maintaining an established connection to
a communication node of a communication network achieves
the object of the invention. The control device is adapted
to receive an acceptance message and issue, if any request
relating to a second procedure is pending, a maintaining
25   request.

According to a fourth aspect of the invention, a
communication apparatus comprising the control device
achieves the object of the invention. The apparatus may be
a mobile radio terminal, a mobile telephone, a pager, a
30   communicator, a personal digital assistant, a smartphone,
or an electronic organizer.

According to a fifth aspect of the invention, a
control device of a network node for maintaining an
established connection to a communication apparatus
35   achieves the object of the invention. The control device is

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adapted to transmit an acceptance message in response to
receiving a request relating to a specific procedure and to
maintain said connection at least a predetermined period of
time or until a maintaining request is received.

5   According to a sixth aspect of the invention, a
network node comprising the network node control device for
maintaining an established connection to a communication
apparatus achieves the object of the invention. The network
node may be a serving GPRS support node (SGSN), a gateway

10   GPRS support node (GGSN), a mobile switching center/visitor
location register (MSC/VLR), a home location register (HLR)
or a gateway mobile switching center (GMSC).

According to a seventh aspect of the invention, a
computer program product embodied on a computer readable

15   medium comprising computer readable instructions for
carrying out the method of the invention when run by an
electronic device of the communication apparatus having
digital computer capabilities achieves the object of the
invention.

20   According to an eighth aspect of the invention, a
computer program product embodied on a computer readable
medium comprising computer readable instructions for
carrying out the method of the invention when run by an
electronic device of the network node having digital

25   computer capabilities achieves the object of the invention
It is an advantage of the invention that the quality
of services to upper layers, e.g. data sessions and SMS, of
a protocol stack with respect to a mobility management
protocol, such as a MM or GMM protocol, may be enhanced.

30   Furthermore, it is an advantage that retransmissions of
signaling messages and service response time will decrease.
Accordingly, the power consumption will be decreased.

Further embodiments of the invention are defined in
the dependent claims.

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It should be emphasized that the term
"comprises/comprising" when used in this specification is
taken to specify the presence of stated features, integers,
steps or components but does not preclude the presence or
5   addition of one or more other features, integers, steps,
components or groups thereof.

Brief Description of the Drawings

Further objects, features, and advantages of the
10   invention will appear from the following description of
several embodiments of the invention, wherein various
aspects of the invention will be described in more detail
with reference to the accompanying drawings, in which:

Fig. 1 is a schematic view of a mobile communication
15   network;

Fig. 2 is a front view of a mobile terminal;

Fig. 3 is a block diagram of some components of the
mobile terminal;

Fig. 4 is a block diagram of a network node;

20   Fig. 5 is a signaling diagram of signals transmitted
between the mobile terminal and the network node;

Fig. 6 is a flowchart of one embodiment of the method
according to the invention carried out in the mobile
terminal; and

25   Fig. 7 is a flow chart of one embodiment of the
method according to the invention carried out in the
network node.

Detailed Description of Embodiments

30   Figs. 1 and 2 illustrate a mobile telecommunication
network and a mobile terminal 10, which may operate in said
network. The mobile terminal 10 comprises an antenna 11 for
transmitting signals to and for receiving signals from a
base transceiver station (base stations) B1-B12 serving the
35   area wherein the mobile terminal 10 is located. Each base

station B1-B12 is part of a radio access network, such as a
UTRAN and/or a BSS. Each base station B1-B12 is controlled
by a controller, such as a radio network controller (RNC),
RNC1-RNC2 of a UMTS system or a base station controller
5   (BSC) BSC1-BSC2 of a GSM/GPRS system. Each BSC/RNC may
control one or several base stations. The radio access
network is connected to the core network (CN), which
typically comprises network nodes for providing connections
to landline communication networks when the mobile terminal
10   10 is involved in communicating speech or data. A mobile
switching center/visitor location register (MSC/VLR) a
gateway mobile switching center (GMSC) and a home location
register (HLR) may provide a connection in the CS domain,
and a serving GPRS support node (SGSN) SGSN1-SGSN2, a HLR,
15   and a gateway GPRS support node (GGSN) in the PS domain.
Each MSC/VLR and SGSN may serve one or several RNC/BSC,
which may be different.

Each base station B1-B12 is part of a user
registration area (URA) URA1-URA5, which comprises one or
20   several base stations. Each URA URA1-URA5 is part of a
registration area (RA) RA1-RA3, which comprises one or
several URA. Furthermore, each RA is part of a location
area (LA) LA1-LA2, which comprises one or several RA.

A user interface of the mobile terminal 10 comprises
25   an earphone or loudspeaker 12, a microphone 13, a display
14, and a user input means, such as a keypad 15.

Fig. 3 illustrates some components, which the mobile
terminal 10 may comprise. The mobile terminal 10 is adapted
to wirelessly communicating speech and data, such as
30   according to the UMTS or GSM/GPRS mobile telecommunication
standards. The mobile terminal 10 comprises e.g. a
modulator 16 connected to a transmitter 17 for transmitting
signals via the antenna 11. Furthermore, the antenna 11 is
connected to a receiver 18, which is connected to a
35   demodulator 19 for receiving signals. The interface for

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communicating with the communication network may comprise
several other components not shown here. The signals
include signaling information in accordance with the air
interface standard of the applicable wireless network or
5   system in which the mobile terminal 10 operates.

The modulator 16 and the demodulator 19 are connected
to a controller 30. The controller 30 comprises circuitry
required for implementing the audio and logic functions of
the mobile terminal 10. The controller 30 may be comprised
10   of a digital signal processor, a microprocessor, various
analog and digital converters, an ASIC (Application
Specific Integrated Circuit) and other components. The
control and signal processing functions of the mobile
terminal 10 are allocated between these components and
15   devices according to their respective capabilities. The
controller 30 also comprises receiver means and issuing
means or transmitting means, such as input and output
terminals, on which messages according to the invention may
be received from/transmitted to the receiver 18 and the
20   transmitter 17, respectively. The controller 30 together
with the output terminal may form the issuing means for
issuing messages according to the invention.

The mobile terminal 10 further comprises various
memories shown collectively as the memory 31. The memory
25   may comprise a RAM (Random Access Memory), a ROM (Read Only
Memory), and a SIM/USIM (Subscriber Identity Module/UMTS
SIM) card. In the memory 31 a plurality of constants and
variables may be stored that are used by the controller 30
during operation of the mobile terminal 10. The memory 31
30   may store permanent and temporal values of various system
parameters and mobile terminal specific information, such
as IMSI and P-TMSI.

The memory 31, in accordance with the aspects of this
invention, also comprises several protocols for initiating
35   and controlling communication using the communication

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interface. Computer readable instructions may be stored in
the memory, which may carry out the method according to the
invention when run by the controller 30 having digital
computer capabilities. Furthermore, the controller 30 may
5   comprise a register for storing data and/or instructions
for carrying out the method of the invention.

       Fig. 4 schematically illustrates the network node,
which is adapted according to the present invention. The
network node may be the SGSN node or the MSC/VLR node, or
10   any other node in the network. The network node comprises a
node controller 50, which is responsible for controlling
and executing network communication and protocol based
procedures, such as according to the MM/GMM protocol. The
node controller 50 comprises circuitry required for
15   implementing the logical functions of the network node. The
node controller 50 may be comprised of one or several
digital signal processors, microprocessors, various analog
and digital converters, ASICs (Application Specific
Integrated Circuit) and other components for communicating
20   with the mobile terminal 10 by means of one or several
access nodes of the communication system, such as the base
stations B1-B12. The node controller 50 is connected to a
receiver unit 51 and a transmitter unit 52 for receiving or
transmitting e.g. data from/to the mobile terminal 10.
25   Furthermore, the node controller 50 may obtain data
required according to the mobility management aspects
according to the invention, such as an identifier of a new
LA or RA in which the mobile terminal has entered, or
obtain a new P-TMSI.
30   The node controller 50 also comprises receiver means
and issuing means or transmitting means, such as input and
output terminals, on which messages according to the
invention may be received from/transmitted to the receiver
unit 51 and the transmitter unit 52, respectively. The node
35   controller 50 together with the output terminal may form

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the issuing means for issuing messages according to the
invention.

For reasons that will be explained below, the network
node comprises a counter or a clock 54 for keeping track of

5   when a specific message was sent to the mobile terminal 10.
The counter or the clock 54 may be reset when the message
is transmitted. Furthermore, when the counter or clock
reaches a predetermined value, the node controller 50 will
be notified. The clock 54 together with the node controller

10   50 may form a waiting device, which is arranged to wait the
predetermined period of time, during which the connection
is maintained. If an acknowledgement message, such as the
COMPLETE message in Fig. 5, is not received from the mobile
terminal in response to the transmitted message when the

15   notification is issued, the connection between the mobile
terminal 10 and the network node may be terminated if no
procedure is utilizing said connection.

The network node further comprises various memories
shown collectively as the memory 53. The network node

20   memory 53 may comprise a RAM (Read Only Memory), and a ROM
(Read Only Memory). In the network node memory 53 are
stored a plurality of constants and variables that are used
by the node controller 50 during operation of the network
node. The network node memory 53 may store permanent and

25   temporal values of various system parameters and mobile
terminal specific information, such as IMSI and P-TMSI
relating to one or several mobile terminals.

The network node memory 53, in accordance with the
aspects of this invention, may also comprise several

30   protocols for initiating and controlling the communication.
Computer readable instructions may be stored in the memory,
which may carry out the method according to the invention
when run by the node controller 50. The node controller 50
may also comprise a register for storing data and/or

35   instructions for carrying out the method of the invention.

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Fig. 5 is a signaling diagram illustrating the
signaling scheme according to the invention. The mobile
terminal 10 comprises a stack of protocols. The MM protocol
is provided for supporting different procedures, e.g.
5   location management, security management, mobile equipment
management, and authentication procedures for executing
security steps, such as network authentication, of a CS
service. The GMM protocol supports PS services. GMM is a
mobility management protocol for supporting procedures such
10 as location management, authentication, temporary identity
management, and equipment check.
       The MM and GMM protocols serve upper layers and
initiate, establish and manage signaling connections for
the layers above them (upper layers) in the protocol stack.
15 The MM and GMM protocols obtain signaling connections, over
which the upper layers may transmit information. Requests
for obtaining the connections are triggered by the GMM/MM
unit. The request to establish or initiate a connection may
be provided by a RRC (Radio Resource Control) message,
20 which may carry a message, such as a layer 3 (L3) message,
e.g. attach request, routing/location area update request,
or a service request initiated by the MM/GMM unit. These
requests may each trigger an establishment of a connection
to the network node. After the signaling connection has
25 been established, the MM/GMM unit of the mobile terminal 10
may transmit to the network node a request for a specific
MM/GMM procedure over said connection. The request may e.g.
be incorporated into a RRC message. In the following, such
a request for a specific MM/GMM procedure is referred to as
30 a REQUEST.
       When the mobile terminal 10 e.g. enters from a first
to a second location area in the CS domain, or from a first
to a second routing area in the PS domain, the mobile
terminal 10 must perform a location updating. Procedures
35 for downloading e.g. parameters for the new LA/RA have to

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be provided when the mobile terminal 10 enters the new
LA/RA. Such requests for mobility management are handled by
the MM/GMM.

In the following, the signaling between the mobile
5   terminal 10 and the network will be explained with regard
to a GMM implementation. However, the signaling may equally
be implemented with regard to a MM implementation. When a
mobility service that needs a connection to the network,
i.e. the SGSN or MSC/VLR, is required by the upper layers,
10   a connection establishment request is transmitted to the
GMM unit in the mobile terminal 10. In response thereto,
the GMM will generate and transmit a REQUEST to lower
layers, which will transmit the REQUEST to the GMM unit of
the network when an signaling connection is established.
15   The REQUEST may comprise a request for a certain service,
such as a request according to the session management (SM)
protocol to obtain a signaling channel to transmit data
over.

The GMM unit may already have an ongoing procedure
20   running when the connection establishment request is
received from the upper layers. Such GMM procedures may
comprise a routing area update request, a security check
request, etc. Thus, the signaling connection, a PS
signaling connection in this case, may be maintained and
25   used by the upper layers. The REQUEST may comprise any
other information relating to the specific request, such as
mobile terminal access capability, routing area identifier,
current P-TMSI, etc., which is implementation specific.

As is known in the art, if the GMM unit receives the
30   connection establishment request relating to a second
procedure from the upper layers before the REQUEST relating
to a first procedure is transmitted, a Follow-On Request
(FOR) may be attached to the REQUEST relating to the first
procedure. Then, the established connection will be
35   maintained when the procedure relating to the first

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procedure is finished, wherein the connection does not have
to be established again. As should be noticed, the second
procedure may relate to the same procedure as the first
procedure. This is e.g. the case if a PS session is turned

5   off at the same time as a RA update is ongoing, wherein the
GMM should execute a detach procedure.

Alternatively, a FOR may be indicated if an event
within the MM/GMM layer itself requires that a second
procedure needs to be performed after a first procedure,

10 such as an ongoing attach or RA update procedure, is
completed.

In response to the REQUEST, the GMM unit of the
network will generate an acceptance message, referred to as
ACCEPT in the following, for indicating that the REQUEST is

15 received and handled. The ACCEPT may comprise any
information relating to the specific REQUEST, such as a new
P-TMSI, routing area identifier etc.

Some GMM services require that the mobile terminal
acknowledges that the data of the ACCEPT message is

20 received. Thus a completion message, referred to as
COMPLETE in the following, for acknowledging completion of
the procedure is transmitted to the network GMM unit, e.g.
as incorporated into a RRC message.

According to the invention, the upper layers (or the

25 internal GMM event) may issue a connection establishment
request relating to a second GMM procedure after the
REQUEST message relating to the first GMM procedure has
been transmitted to the network GMM unit. If the ACCEPT
message issued in response to the REQUEST message relating

30 to the first procedure has not been received before the
connection establishment request relating to the second
procedure is received from the upper layers, the FOR
request may according to the invention be incorporated into
the COMPLETE message finishing the procedure relating to

35 first GMM procedure. A single bit in the COMPLETE message

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may implement the FOR request, wherein "1" indicates that
FOR is valid, and "0" indicates that FOR is not valid. If
FOR in the COMPLETE message is valid, the network GMM unit
will maintain the connection, otherwise the connection is

5   terminated when the procedure relating to the first GMM
procedure is terminated.

As not all GMM procedures require a COMPLETE message
the network GMM may not expect it. To be able to maintain
the connection if a FOR will be issued in such a case, the

10   network GMM unit may always wait for a COMPLETE message a
predetermined period of time or until the message is
received before the connection may be terminated. The time
period may range from seconds to minutes, and may be tested
in each particular case. If no COMPLETE message is received

15   within the time period, the connection may be terminated
whenever the connection is not utilized.

Alternatively, if the network GMM unit does not
expect a COMPLETE message, it is arranged to not wait for
any COMPLETE message. However, the mobile terminal may

20   anyway issue the COMPLETE message, although the network
will discard the message without any further processing.

When the mobile terminal 10 has transmitted the
COMPLETE message, it will transmit a connection
establishment confirmation to the appropriate requesting

25   protocol of the upper layer. The confirmation indicates
that a signaling connection is available.

Fig. 6 illustrates the steps of one embodiment of the
method according to the invention, which may be executed in
the mobile terminal 10. In a first step 100, the GMM

30   initiates a GMM procedure. In response thereto, the signal
connection establishment procedure is initiated in step
101. In step 102, the REQUEST with regard to the GMM
procedure is transmitted to the network GMM. Step 101 and
102 may be executed in a single step as described above. In

35   step 103 the ACCEPT message is received from the network

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GMM. As the COMPLETE message has not yet been transmitted,
· in step 104 it is determined whether the GMM has a pending
request for a connection establishment, i.e. if a
connection establishment request relating to a second GMM
5   procedure is received from the upper layers (or triggered
by an internal GMM event) after the REQUEST was
transmitted. If the answer in step 104 is yes, the FOR bit
in the COMPLETE message is set to "valid" in step 105.
However, if the answer in step 104 is no, it is determined
10   in step 106 whether the procedure relating to the received
ACCEPT message required a COMPLETE message. If the answer
in step 106 is no, the procedure is ended. However, if the
answer in step 106 is yes, the FOR bit in the complete
·message is set to "not valid" in step 107. The procedure
15   continues from step 105 and 107 in step 108, wherein the
COMPLETE message is transmitted to the network GMM. The
signaling procedure may be ended when the connection is no
longer in use.
        A response or acknowledgement message may
20   alternatively always be sent regardless of whether it was
requested by the network node or not. Then, the FOR bit of
the COMPLETE message may be set to "valid" or "not valid".
If the network node was not expecting the response message,
it does not have to pay any attention to the message, which
25   may be discarded without any further processing.
        Fig. 7 illustrates one embodiment of the steps
carried out in the network node according to the method of
the invention. In a first step 200 the signaling connection
is established, and the REQUEST relating to the GMM
30   procedure is received in step 201. Step 200 and 201 may be
executed in a single step if the REQUEST is received
together with the request to establish the signal
connection. Then the specific procedure relating to the
REQUEST, such as a routing area update request, is
35   identified. The network GMM performs any function required

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according to the procedure specified by the REQUEST, such
as identifying a new RA and allocating a new P-TMSI. Any
data that should be transmitted to the mobile terminal GMM
is incorporated into the ACCEPT message, which is
5 transmitted in step 202. The network GMM may then wait in
step 203 a predetermined period of time for receiving a
COMPLETE message in response to the transmitted ACCEPT
message, during which the connection is maintained.
Alternatively, if the COMPLETE message is required
10 according to the ACCEPT message, the GMM waits until the
COMPLETE message actually is received. In step 204 it is
determined whether the COMPLETE message was received within
the predetermined period of time. If the answer in step 204
is yes, the procedure continues in step 205, wherein it is
15 determined whether FOR of the COMPLETE message is "valid".
If the answer in step 205 is yes, the procedure continues
in step 206, wherein the established connection is
maintained. When the connection maintained in step 206 is
no longer in use, the connection may be terminated, wherein
20 the procedure is ended. However, if the answer in step 204
or 205 is no, the procedure continues in step 207, wherein
the connection is disconnected when the signaling
connection is no longer in use by the GMM procedure.

If the network GMM unit does not expect any COMPLETE
25 message, the procedure in Fig. 7 may proceed directly from
step 202 to step 207.

If the above methods are used in the CS domain, the
FOR request may have to be acknowledged by the network node
by transmitting a Follow-On Proceed (FOP). If the FOR
30 request is incorporated into the REQUEST message, the FOP
may be incorporated into the ACCEPT message. However, if
the FOR request is incorporated in the COMPLETE message,
the FOP acknowledgement may be transmitted separately, or
incorporated into another message transmitted between the
35 network MM and the mobile terminal MM.

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The present invention has been described above with
reference to specific embodiments. However, other
embodiments than the above described are equally possible
within the scope of the invention. Different method steps

5   than those described above, performing the method by
hardware or software, may be provided within the scope of
the invention. The different features and steps of the
invention may be combined in other combinations than those
described. The invention is only limited by the appended
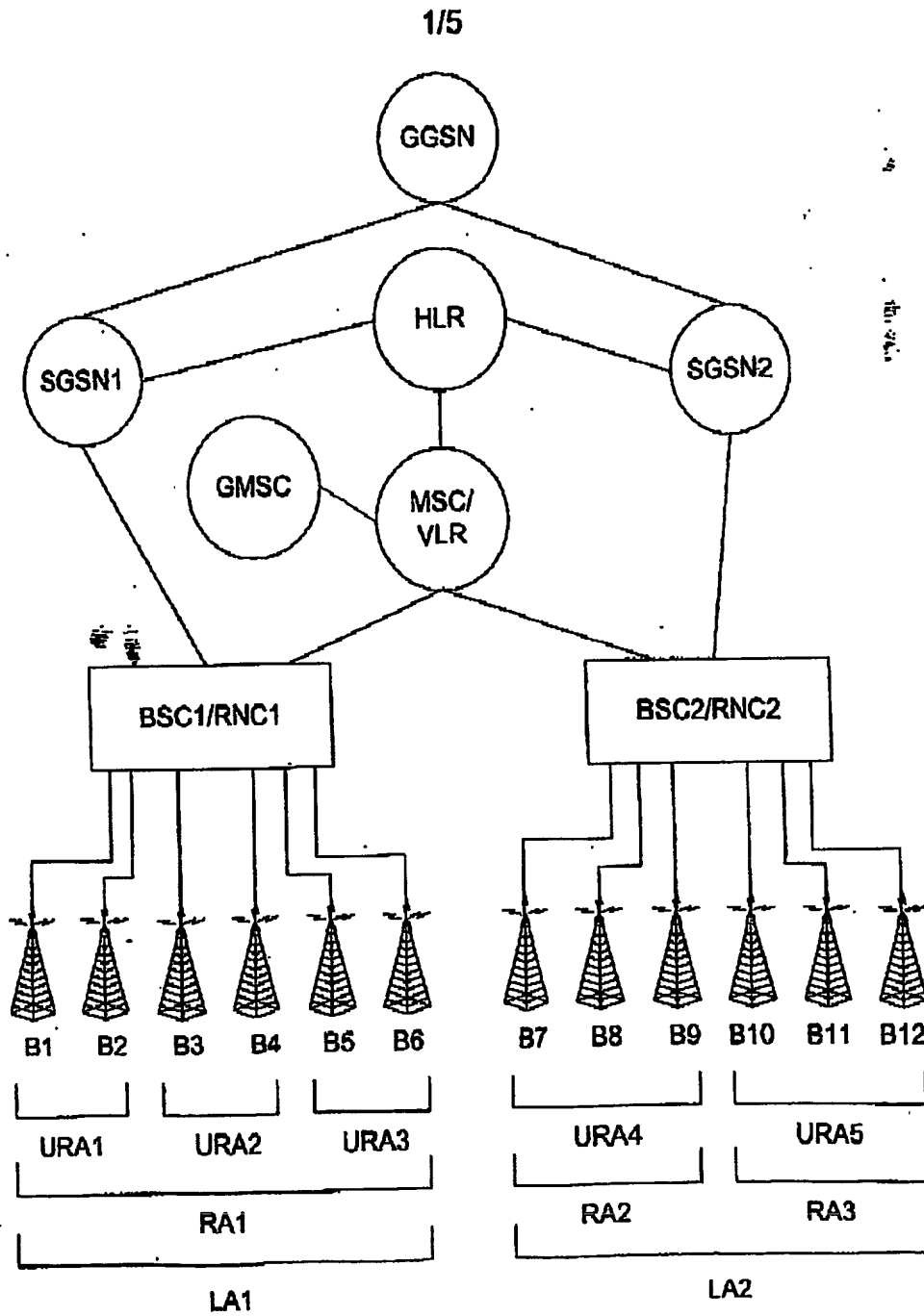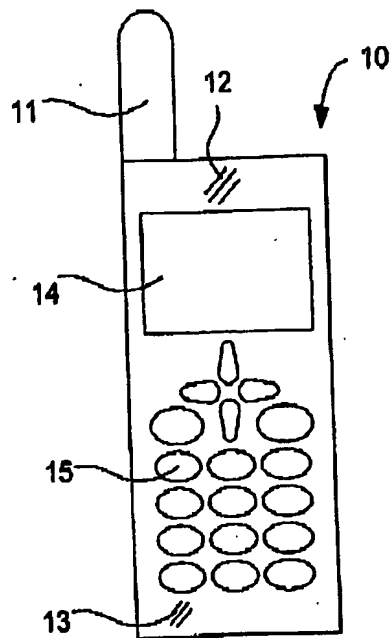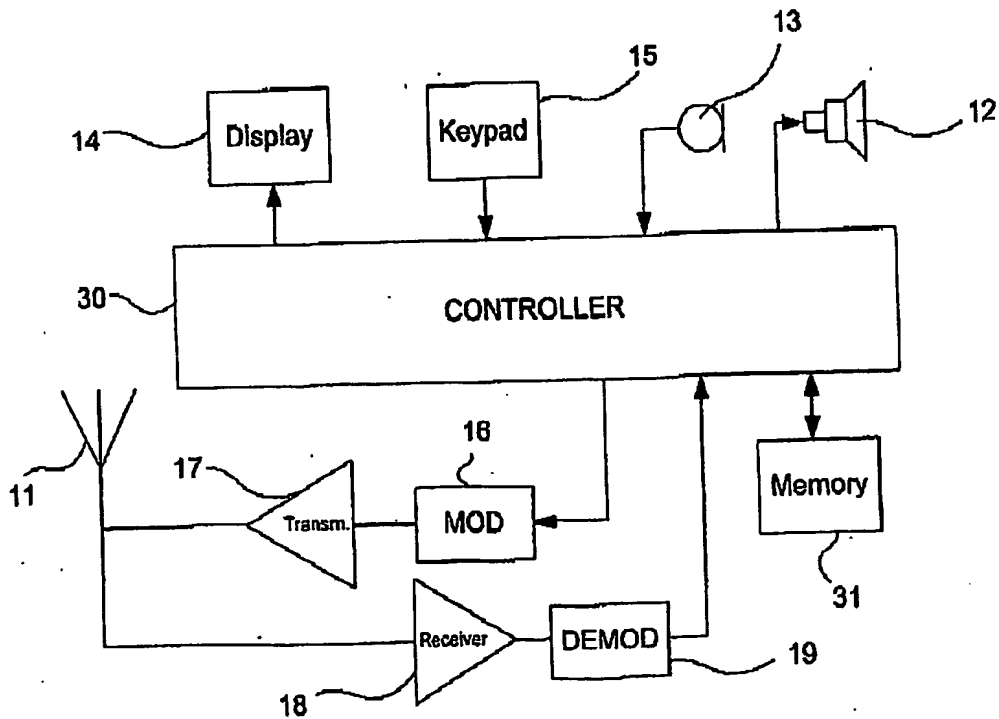
10   patent claims.

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ABSTRACT

A method and a device in a communication apparatus
for maintaining an established connection between said
5 apparatus and a network node. The connection is established
by a mobility management unit for providing a mobility
management procedure. An acceptance message is issued by
the node in response to a request relating to a first
mobility management procedure. If any request relating to a
10 second mobility management procedure issued by an upper
layer is received by the mobility management unit after the
request relating to the first procedure is transmitted and
before the acceptance message is received, a maintaining
request to maintain the connection is transmitted to the
15 node in response to the acceptance message.

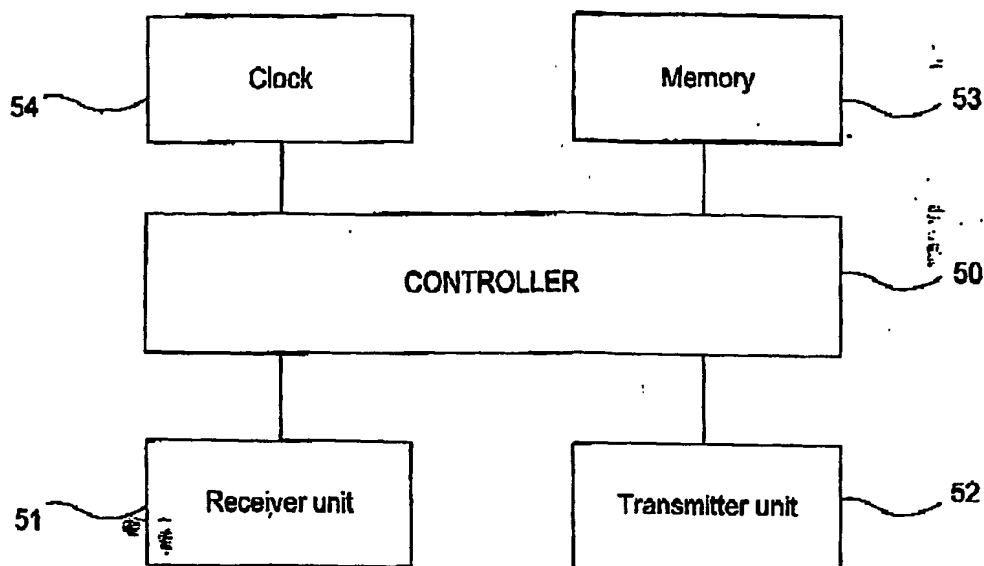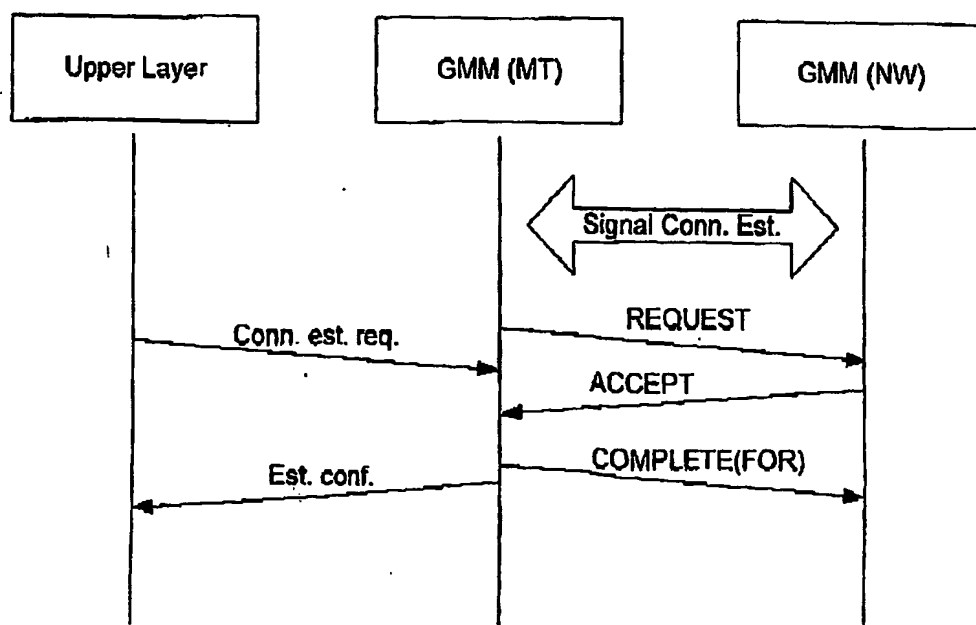To be published together with Fig. 5.

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Fig. 1

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Fig. 2

Fig. 3

Fig. 4

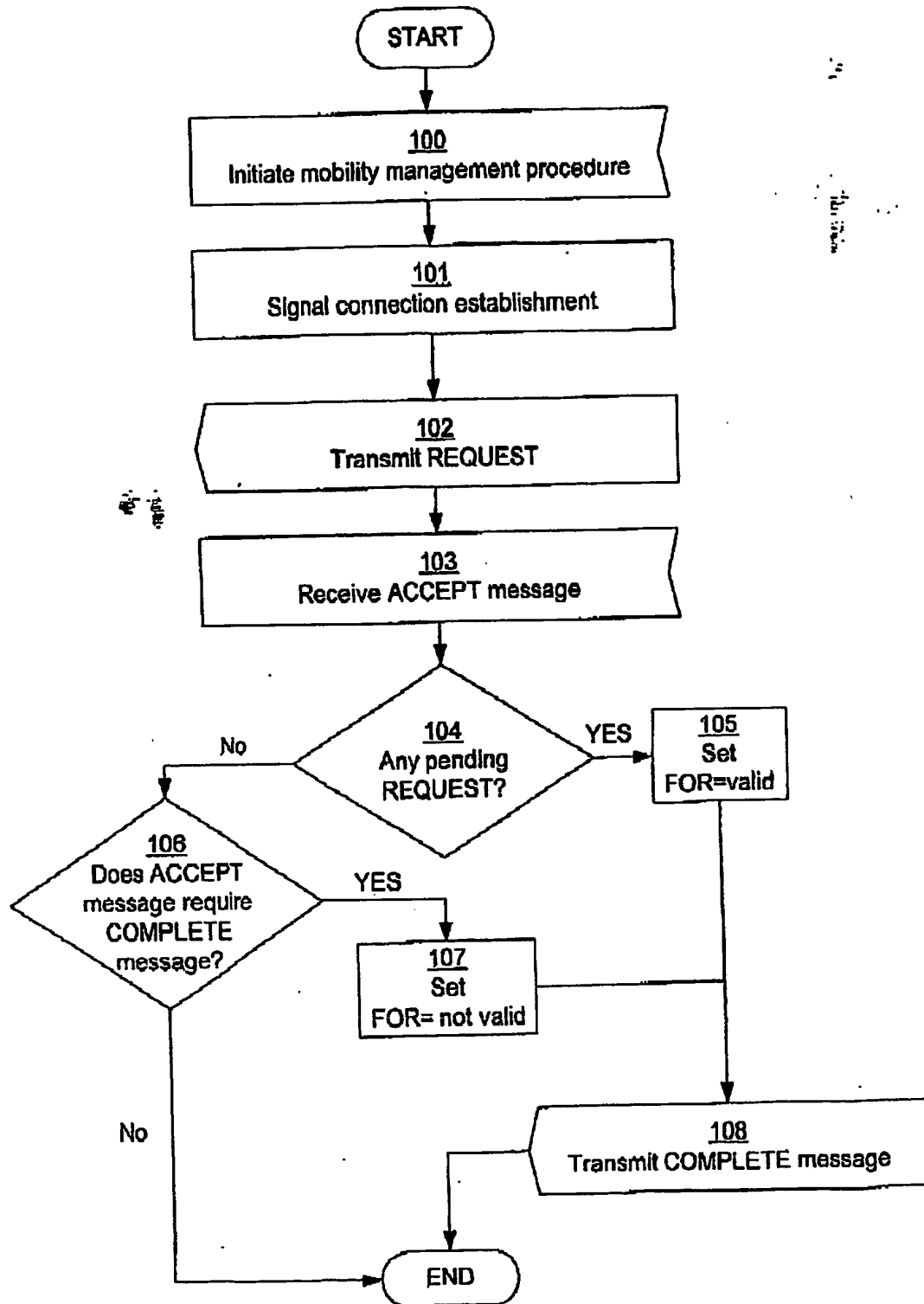
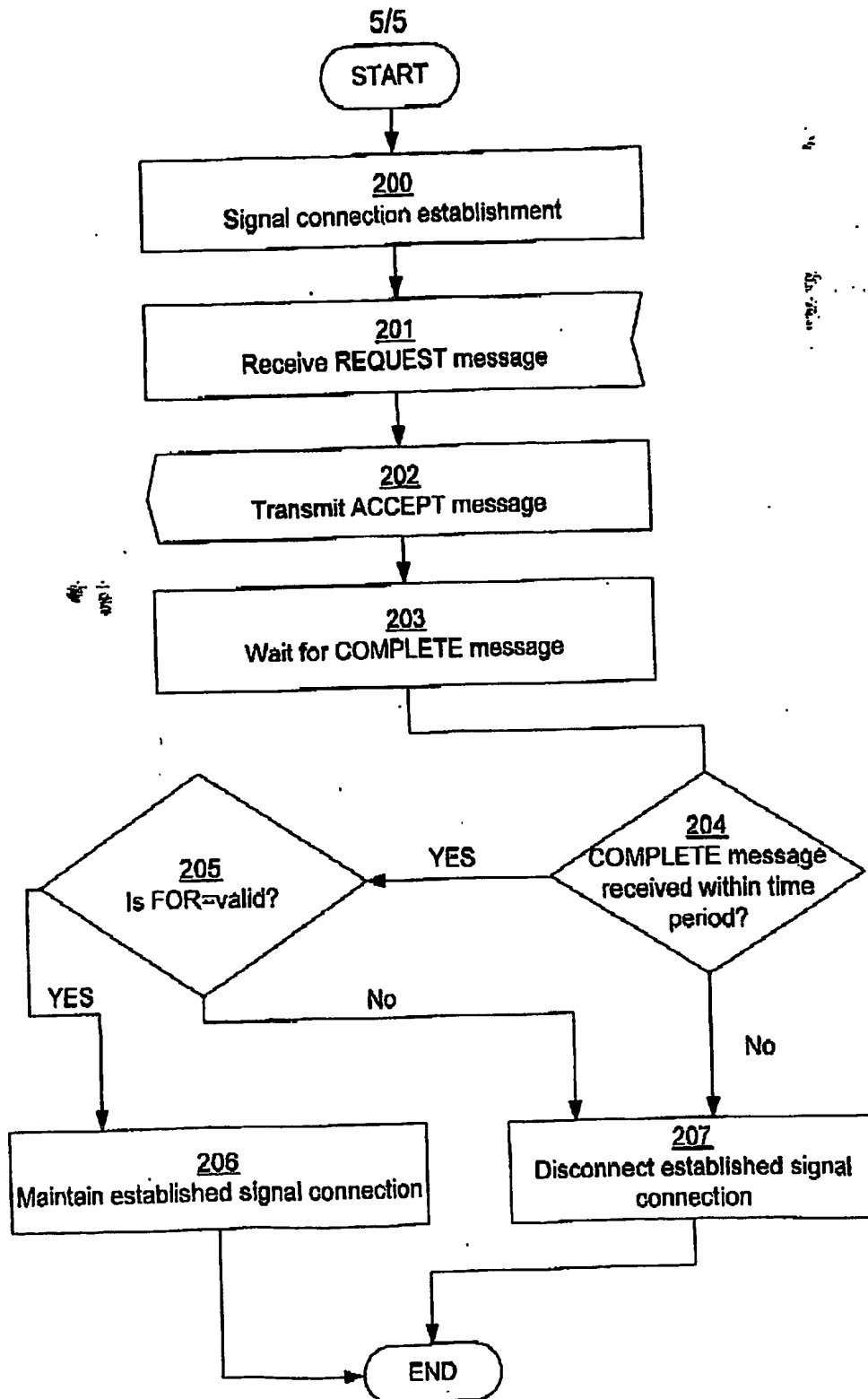Fig. 5

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```
                        ┌─────────┐
                        │  START  │
                        └─────────┘
                             │
                             ▼
              ┌──────────────────────────────┐
              │            100               │
              │ Initiate mobility management │
              │          procedure           │
              └──────────────────────────────┘
                             │
                             ▼
              ┌──────────────────────────────┐
              │            101               │
              │ Signal connection establishment │
              └──────────────────────────────┘
                             │
                             ▼
              ┌──────────────────────────────┐
              │            102               │
              │        Transmit REQUEST      │
              └──────────────────────────────┘
                             │
                             ▼
              ┌──────────────────────────────┐
              │            103               │
              │     Receive ACCEPT message   │
              └──────────────────────────────┘
                             │
                             ▼
```

104
Any pending
REQUEST?

No ◄─────── YES ───────►

105
Set
FOR=valid

106
Does ACCEPT
message require
COMPLETE
message?

YES

107
Set
FOR= not valid

No

108
Transmit COMPLETE message

END

Fig. 6

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```
         ┌──────────┐
         │  START   │
         └──────────┘
               │
               ▼
   ┌───────────────────────────┐
   │           200             │
   │ Signal connection establishment │
   └───────────────────────────┘
               │
               ▼
   ┌───────────────────────────┐
   │           201             │
   │  Receive REQUEST message  │
   └───────────────────────────┘
               │
               ▼
   ┌───────────────────────────┐
   │           202             │
   │  Transmit ACCEPT message  │
   └───────────────────────────┘
               │
               ▼
   ┌───────────────────────────┐
   │           203             │
   │ Wait for COMPLETE message │
   └───────────────────────────┘
```

205 Is FOR=valid?

204 COMPLETE message received within time period?

YES

YES   No   No

206 Maintain established signal connection

207 Disconnect established signal connection

END

Fig. 7